

March 15, 2003

Dr. Andrew Christensen, Chair
Space Science Advisory Committee

Dear Andy,

The Structure and Evolution of the Universe Subcommittee (SEUS) met at JPL on the 27th and 28th of February 2003. We would like to express our thanks to our JPL hosts for their wonderful hospitality. In particular, the ability for members of the committee to communicate electronically during the meeting greatly facilitated the preparation of this letter and the overall effectiveness of the Subcommittee. (This ability is sadly lacking for meetings at NASA Headquarters.) The JPL tour was also helpful for the committee to understand the scope of SEU activities at JPL.

The meeting opened as a joint meeting with the Origins Subcommittee. The first order of business was to hear an Astronomy and Physics update from Anne Kinney. The SEUS was delighted to hear that the Beyond Einstein initiative was included in the President's FY04 budget. The SEUS would like to express thanks to Anne Kinney, Paul Hertz, Nick White, and the entire Headquarters staff for the hard work that led to the Beyond Einstein Initiative being placed in the President's FY04 budget. The rapid progress of this initiative has already led to a provisional scheduling of LISA and Con-X that will be reviewed in the TRIP report. We are happy to work with Anne further to advance the Initiative. Important in this regard is to design the program to provide adequate funds in the R&A budget. We fully support efforts to develop interagency coordination to accomplish goals in the Strategic Plan and the Beyond Einstein Initiative

Drs. Kinney and Hertz reported on the latest issues having to do with the Gravity Probe B (GP-B) mission. The latest replan would call for substantial additional funds for the mission. We realize that the funds would have to come out of the money put aside for other SEU missions and activities. We strongly endorse the OSS plan to scrutinize closely the status and prospects of GP-B prior to making any additional commitments. It makes good sense to appoint separate technology and science review panels, and to ask them to provide a rapid and unambiguous assessment of whether GP-B can meet its technical and scientific goals, and the likely importance of the GP-B science goals in light of current knowledge. We recognize that the amount of money required in the most recent replan is large enough that it has a potential impact on the entire Astronomy and Physics program; consequently, it is important that these panels are broadly representative of the entire space astrophysics community. The science panel especially should be capable of making assessments of overall science value from a broad perspective. We hope that the panels will be asked to consider the opportunity cost of any proposed GP-B replan, especially with regard to other gravity community missions like LISA. We also note that substantial extra expenditure on GP-B might delay other

missions in Beyond Einstein initiative such as Con-X, LISA, and Einstein probes. (The entire initiative is centered on the theme of GR.) We hope to hear at our next meeting a report on the outcome of the panel recommendations regarding GP-B.

The joint SEUS/OS meeting then heard of the progress toward defining the SAFIR mission. The SEUS recognizes the Far-Infrared/Submillimeter consensus white paper "Community Plan for Far-Infrared/Submillimeter Space Astronomy" and commends the thought and effort that has been invested in the SAFIR science team study over the past year. The funds that NASA provided for this "seed" endeavor have been used effectively. We encourage NASA to continue to support such seed activities as they benefit highly valued missions. SAFIR is poised to benefit dramatically from focused technology investment. The SEUS is encouraged by recent efforts taken by the SAFIR community to take advantage of science-driven technology funding opportunities, such as those offered by the New Millenium Program and Code R. The SEUS recommends that appropriate measures be taken to foster focused technology that would advance promising mission concepts such as SAFIR.

Meeting with just the SEUS, Paul Hertz presented an update of the SEU theme and the Beyond Einstein Initiative. The SEUS was pleased to see that all SEU missions with the exception of GP-B are "green."

The SEUS gave a lot of careful attention to the review of the OSS strategic plan. The concerns and suggested modifications to the strategic Plan were communicated to the SScAC and to Marc Allen.

The most difficult issue the SEUS faced was that of the question of NASA participation in the Russian Radioastron project. Radioastron is a mission that would involve a 10-meter antenna in Earth orbit used in conjunction with a worldwide VLBI network for high-resolution imaging. The major goal of the mission is to obtain 1.5-microarcsecond resolution of AGNs (active galactic nuclei). The National Academy of Sciences Panel recommended the Radioastron mission in 1990. The breakup of the Soviet Union delayed the launch, now scheduled for 2006. Subsequent to the NAS recommendation, the Japanese VSOP mission was launched in 1997 and is still in operation. Furthermore, the US space-VLBI mission ARISE (the international version is iARISE) was recommended by the 2000 Academy decadal survey. Also on the international scene, the Japanese plan a follow-up mission to VSOP, called VSOP2, with launch possibly in 2009. NASA participation in Radioastron would cost at least \$12M, assuming a 2006 launch. Launch slips could increase costs. The SEUS was asked if realistically expected science return from Radioastron is sufficient for NASA to commit the necessary resources. The committee appreciated the complete presentations that were made regarding the Radioastron scientific goals and mission development by Ed Fomalont and Jeff Hayes. We are hopeful that the Russian space program will thrive as a partner in future international space astrophysics programs. With regard to the Radioastron mission, the committee notes that the 2006 launch date for Radioastron contains little margin for error, including both financial and technical contingencies. The SEUS was tasked to consider the potential scientific payoff of Radioastron in light of the

opportunity cost. Considering the many other projects whose scientific goals are worthy of support, we recommend against NASA investing significant funding in Radioastron.

The subcommittee received an update on the Herschel Project from Harold Yorke. Herschel is a 3.5-m far-IR/submillimeter telescope with three instruments. It is an ESA cornerstone mission with NASA participation. It is co-manifested for launch with Planck in 2007. At the present time, the Herschel project is on track and robust. Despite some schedule slips, there is no reason to believe that JPL might fail to deliver critical-path hardware on time. Some concern remains as to whether or not European instrument teams and Alcatel will be able to meet their ambitious schedules, though this has no direct effect on US deliverables. A critical hardware test (HIFI Band 6H) will take place this June, and SEUS looks forward to hearing the results of this test at the next subcommittee meeting. Recognizing the unique scientific potential offered by the Herschel Space Observatory and the progress made toward realizing this potential by the NASA Herschel project, the SEUS enthusiastically endorses NASA's continued commitment. The US community should receive adequate support enabling the effective utilization of this potential throughout the course of the Herschel mission.

The SEUS thanks Charles Lawrence for his clear exposition of the status of Planck. The failure of ASI to fund the 100 GHz LFI channel is very unfortunate but appears to be an accomplished fact. The coherent LFI receivers considerably enhance the overall Planck mission and having an overlap of the two instruments, LFI and HFI, at 100 GHz would have allowed a significant reduction of systematic errors. The proposal to use polarization sensitive bolometers in the 100 GHz HFI channel recovers a very valuable scientific capability, and should be considered very seriously and quickly by NASA. The sensitivity of Planck at 100 GHz will be more than 10 times higher than the MAP 94 GHz sensitivity.

The committee again wishes to emphasize the value and importance of the suborbital balloon program, in particular the developing 100-day ultra-long duration balloon initiative. We are encouraged by the agreements between NASA and NSF to maintain the Antarctic balloon flight program. We would also suggest NASA continue discussions with the Russians to provide circumpolar flights in the Arctic. Balloons offer unique opportunities for developing new instrumentation and training students. However, especially for the 100-day ULDB flights the payloads have grown beyond the scope of the R&A program. We suggest a method for funding payloads at the level of approximately \$10M per year be developed to provide timely access for this emerging capability.

Sincerely,

Rocky Kolb, Chair,
for the Structure and Evolution of the Universe Subcommittee